Amount of exposure as a proxy for dominance in bilingual language acquisition

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1. Introduction

It is well known in the literature on bilingual acquisition that 'balanced' bilinguals, i.e., bilinguals who are equally proficient in their two languages, are rare (e.g., Grosjean, 1982, 2010). This holds not only for the end state which bilinguals reach, but also for the developmental stages which they pass through on their way. Typically, bilingual children, even if exposed to both languages from birth, are more proficient, or *dominant* in one of their two languages (e.g., Paradis, 2007). In any accurate assessment of bilingual children's linguistic abilities, it is important that such differential capabilities are taken into account, whether this is for the purposes of assessing bilingual children in comparison with their monolingual peers, comparing and contrasting the linguistic development of different groups of bilingual children, or examining possible bilingual language outcomes.

One of the problems facing both researchers and language professionals alike is how to operationalise *dominance* in an effective yet efficient manner (see e.g., discussion in Kupisch, 2004; Yip & Matthews, 2007). Probably the most common approach is to analyse a sample of the child's productions using one or more performance-based measures such as mean length of utterance (MLU) as an estimation of language dominance. An alternative approach, adopted in a variety of ways by a number of studies (e.g., Argyri & Sorace, 2007; Döpke, 1992; Foroodi-Nejad & Paradis, 2009), is to use experiential variables such as the relative amount of exposure which children receive as a proxy for language dominance. The underlying assumption here is that children's relative proficiency in their two languages is in

some sense a function of the amount of language to which they are exposed in those languages. In this paper we explore the extent to which children's language experience and their absolute and relative language proficiency are related, with a view to determining whether measures of language experience should be used as indicators of language dominance in studies of bilingual language acquisition. For the purposes of this paper, a narrow definition of language dominance is adopted, that is, language dominance is understood as bilingual children's *relative proficiency* in their two languages. As discussed in detail by Montrul (this volume), language dominance can also be conceived of as a much broader concept, involving "a linguistic proficiency component, an external component (input), and a functional component (context and use)" (p. 4 of manuscript). My goal here, then, is to explore the relationship between these various component parts.

2. Language experience and language development in bilingual children

There are numerous factors affecting bilingual children's language environments, including parental language strategy, the status of the language(s) (minority/majority, high/low prestige), type of education (monolingual/bilingual/immersion etc.), siblings and birth order, literacy and literacy-related activities, amongst others. These factors can affect both the amount and type of language exposure available, leading to considerable variability in bilingual children's language experiences. Like monolingual children, and probably even more so, bilingual children also vary in the rate at which they acquire their two languages.

A number of recent studies have claimed that differences in rate of acquisition, both within and amongst bilingual children, and when comparing bilinguals with

monolinguals, can be related to differences in language input (see e.g., Hoff et al., 2012). More specifically, it has been claimed that both quantitative and qualitative properties of the input may affect bilingual children's (rate of) language development (e.g., Sorace, 2005). These include, for input quantity, children's current amount of exposure (at home and/or at school) (e.g., Chondrogianni & Marinis, 2011; Gathercole & Thomas, 2009) and their cumulative exposure over time (Gutiérrez-Clellen & Kreiter, 2003; Unsworth, 2013), and for input quality, richness of children's language input, defined as input from a variety of difference sources, e.g., TV, reading, friends, etc.. (Jia & Fuse, 2007), the variety of speakers providing language input (Driessen, van der Slik, & De Bot, 2002; Place & Hoff, 2011), whether input-providers speak the language in question exclusively with the child (Place & Hoff, 2011) and whether they are native or non-native speakers (Place & Hoff, 2011), as well as the number and type of literacy-related activities (Scheele, Leseman, & Mayo, 2010).

Input effects have been observed for a range of different aspects of bilingual children's language proficiency, such as vocabulary (Barnes & García, in press; David & Wei, 2008; Thordardottir, 2011), aspects of morphosyntax such as MLU (Hoff et al., 2012; Place & Hoff, 2011) and verbal morphology (Blom, 2010; Nicoladis, Palmer, & Marentette, 2007; Paradis, 2010; Paradis, Nicoladis, Crago, & Genesee, 2011), as well as certain phonological abilities (Nicoladis & Paradis, 2011; Sundara, Polka, & Genesee, 2006).

Another important aspect of bilingual children's language experience which has been related to their rate of acquisition is language use or output, i.e., the extent to which children actively speak the language in question. Several recent studies have highlighted the role of children's output as a significant predictor of children's

developing language abilities (Bohman et al. 2010; Hammer et al., 2012; Montrul, 2008; Paradis, 2011; but cf. Driessen et al., 2002).

To summarise, bilingual children's (rate of) acquisition has been linked to both quantitative and qualitative properties of their language experience, including amount of exposure, children's own language output, and whether input is from native or non-native speakers; whilst these factors have been related to absolute measures of proficiency such as MLU and vocabulary size, their relation to children's relative proficiency, i.e., to their patterns of language dominance, remains largely unexplored.

3. Language dominance in bilingual children

Language dominance in bilingual children, defined here in terms of (relative) proficiency (following e.g., Genesee, Nicoladis, & Paradis, 1995; Petersen, 1988; Yip & Matthews, 2007 amongst others), has been linked to rates of mixing (Kupisch, 2008) and to the direction of crosslinguistic influence (e.g., Yip & Matthews, 2007). The effects of language dominance have been found to be moderated by other factors such as sociolinguistic setting (Foroodi-Nejad & Paradis, 2009) and linguistic complexity (Kupisch, 2007); dominance has been shown to change over time (e.g. Leopold, 1939, 1947; Nicoladis & Genesee, 1996a) and it can also vary in degree (Grosjean, 1982, 2010).

Whilst there is consensus that language dominance exists in bilingual acquisition, there is little consensus to how it can best be measured. The most commonly used measures are usually based on spontaneous speech data and include measures of children's abilities, such as MLU (most frequently in words), upper

bound i.e., the longest utterance (or X number of utterances) produced by a child in a given sample, and the number of different words or verb and/or noun types, as well as more general measures of children's language productions such as (direction of) mixing and total number of utterances in a sample (see Cantone, Müller, Schmitz, & Kupisch, 2008; Kupisch, 2007; Nicoladis & Genesee, 1996b; Yip & Matthews, 2006 for overviews). Other performance-based measures, not based on spontaneous speech data, include scores on standardised vocabulary and grammar tests (e.g., Bedore et al., 2012).

Yip and Matthews (2006 and see also this volume) introduce the notion of *MLU differential* as a means of comparing dominance within and between children with the same language pair. They define MLU differential as "[t]he difference between MLU scores for a child's two languages at a given sampling point or (expressed as a mean) over a period of development" (p. 108). In their study of the acquisition of null objects by Cantonese-English bilingual children, they observed that the extent to which Cantonese-dominant children (incorrectly) used null objects in their English was related to the size of their MLU differential, that is, children with a larger MLU differential were more likely to exhibit language transfer.

Another approach to measuring dominance in bilingual language acquisition is to use some experience-based variable such as language of the community or amount of exposure as a proxy for relative proficiency. Indeed, the amount of input to which children are exposed in their two languages has long been thought to be a determinant in establishing language dominance (Döpke, 1992; see also Montrul, this volume). The advantage of this approach is that such experiential variables are based on information which is typically easier to collect than some of the more direct, performance-based alternatives mentioned above. It is, however, not clear to what

extent indirect measures of relative proficiency, such as amount of exposure, and more direct measures, such as e.g., MLU and number of different verb types, are related to each other, i.e., whether they do indeed tap into the same construct. Furthermore, more generally, little is known about the potentially differential importance of certain aspects of (amount of) exposure as they relate to language dominance when defined as relative proficiency; it is possible that some of the more specific qualitative as well as quantitative aspects of exposure may also have to be taken into account (Jia, Aaronson, & Wu, 2002; La Morgia, 2011 and this volume; Place & Hoff, 2011; Sorace, 2005).

The relationship between performance-based and experiential-based measures of language dominance has been explored in a recent paper by Bedore et al. (2012). In their study of over one thousand bilingual Spanish-English 5 year olds, patterns of language dominance were found to be best predicted by children's current language usage i.e., a combination score based on their amount of exposure and their own language output.

To summarise, whilst it is widely agreed that language dominance in the sense of differences in relative proficiency exists in bilingual children, how best to measure this and the extent to which this relates to – and is potentially determined by – children's language experience, remains unclear.

The present study has two research questions. First, it asks for simultaneous bilingual children to what extent quantitative and/or qualitative properties of bilingual language experience are related to commonly-used performance-based measures of absolute and relative language proficiency. Second, more generally, it investigates whether, assuming that such a relationship exists, any of these experiential variables

might usefully be implemented in future studies as a proxy for language dominance, understood here in the narrow sense of relative proficiency.

4. Method

4.1 Participants

Participants were 18 simultaneous bilingual children aged between two and four years old (*M* = 3;8; *SD* 0;7) being raised in English and Dutch following the 'one parent, one language' principle. All were resident in the Netherlands and had been exposed to both languages from birth.[1] At the time of testing, ten of the mothers and six of the fathers (almost) always spoke English to their child, five mothers and eight fathers (almost) always Dutch, three mothers and three fathers mostly spoke Dutch, and one father mostly spoke English. All but one child had siblings; 11 children were first-born, six had one older sibling and one was the youngest of three. With just four exceptions, all (older or same-age[2]) siblings (almost) always spoke Dutch with the participating child. There were 12 children attending daycare, five attending school and one child transitioning from daycare to school; the language of communication at all schools and daycares was Dutch. All participating families were high SES, as measured by parental level of education.

4.2 Materials and procedure

[1] Two other children were tested but were subsequently excluded when the questionnaire data revealed they were first exposed to Dutch at a later age.

[2] Two of the children are twins.

In line with previous research examining language dominance in bilingual children, spontaneous speech data were used to calculate a range of measures commonly used in the literature. Children were video-recorded in a half-hour interaction in each language with the parent who normally spoke that language with the child, resulting in one hour of language data per child in total. The parent was asked to play with their child as naturally as possible; activities typically involved playing with stickers, colouring, and playing games, and these were by and large consistent across children and across languages. This spontaneous play was recorded by a (near-)native-speaker research assistant, who interacted with child and parent as little as possible and only in the language of the recording. Subsequently, the same assistant transcribed the data using CLAN/CHAT (MacWhinney, 2000) and these were then checked by a second assistant; where discrepancies arose, a third person functioned as arbiter. The following utterances were excluded from analysis: incomplete utterances (e.g., trailing off), direct imitations of interlocutor, self-repetition, series of utterances including episodes of counting, utterances containing unintelligible parts, and – for all analyses except those concerning language mixing – any utterances in or containing words from the other language (with the exception of proper names and accepted loanwords).

The total number of (monolingual) utterances in the sample (UTT), the average length of the longest five utterances in the sample (Upper Bound, UB5), and MLU in words were calculated automatically using CLAN. The FREQ function was used to generate a list of words for each sample and the number of different verbs (VERBS) and nouns (NOUNS) was counted manually; any ambiguities were checked against the original transcript. Given the differences in sample size across children and languages (cf. Table 2), and following common procedure in the field, data were

analysed for MLU for the first 100 utterances only and by analogy, VERBS and NOUNS; where fewer than 100 utterances were available, all utterances were included.[3] The rate of mixing (MIX) was calculated by dividing the number of utterances containing one or more words from the other language by the total number of utterances in the sample, i.e., both intra- and inter-utterance mixings were included (Genesee, 1989).

In order to assess children's *relative* proficiency in Dutch and English, differential scores were calculated, following Yip and Matthews (2006), by subtracting children's scores in English from their scores on the same variable in Dutch. This resulted in differential scores for MLU, UB5, VERBS, NOUNS and vocabulary scores.

In addition to the above indicators of children's language abilities, receptive vocabulary skills were also assessed using standardised vocabulary tests: PPVT-4 (Dunn & Dunn, 2007) or BPVS-2 for English, depending on the variety of English the child was acquiring, and PPVT-III-NL (Dunn, Dunn, & Schlichting, 2005) for Dutch. Raw scores were converted to standard scores following the procedure in the manual; a score of between 85 and 115 indicates age-appropriate development for a monolingual child. These vocabulary tests were included for two reasons: first, they serve as an additional and more specific indicator of lexical knowledge than VERBS and NOUNS, i.e., the only other measures which in some sense reflect this aspect of children's language, and second, bilingual children have been shown to have smaller vocabularies than their monolingual peers in (at least) one of their two languages

[3] For Dutch, all but one child produced at least 100 utterances in 30 minutes. For English, 11 children did not reach 100 utterances in this time period (see Table 2 for mean and standard deviations per language).

(e.g., Bialystok, Luk, Peets, & Yang, 2010) and hence, dominance patterns may be readily detected in this domain.

Information concerning the children's language experience was collected using an extensive parental questionnaire (following Gutiérrez-Clellen & Kreiter, 2003; Jia & Aaronson, 2003; Paradis, 2011; Unsworth, 2013). These data were used to calculate the following language experience variables, based on those examined in previous literature: the proportion of English/Dutch exposure at the current time (AMOUNT), the relative proportion of each language spoken by the child at home (OUTPUT), *cumulative* length of exposure, i.e., the total amount of exposure from birth to the child's current age, taking into account any variation over time (CumuLoE; see Unsworth [2013] for details), the proportion of extra-curricular activities in English/Dutch (RICHNESS), the average quality of English/Dutch exposure at home in terms of its native/non-nativeness (NATIVE), the number of exclusively English/Dutch-speaking conversational partners at home (EXCL) and the number of different English/Dutch-speaking conversational partners at home (VARIETY).

For AMOUNT, input at home and at daycare/school were included. For OUTPUT, children's own language use was averaged across all interlocutors at home i.e., parents, siblings and any other adults with whom there was regular interaction e.g., babysitters, grandparents. The following activities were included in RICHNESS: watching TV, computer games involving language, being read to, sports and cultural activities or lessons, and interaction with friends outside daycare/school. A scale of 0 (no fluency) to 5 (native(-like) fluency) was used for NATIVE. Conversational partners were counted as being exclusively English- or Dutch-speaking for EXCL if the person in question spoke English or Dutch to the child and vice versa for at least

90% of the time. Finally, a person was counted as being English- or Dutch-speaking for VARIETY if they addressed the child in that language for at least 25% of the time.

Children were tested at home on separate occasions in each language, with no more than two weeks between sessions, and with one exception, the following test order was used: vocabulary task followed by parent-child interaction. At the end of the session, the parent answered the background and language experience questionnaire; this was completed by one parent only.

5. Results

The results are organised as follows. First, descriptives for the language experience variables are presented in §5.1 and for the absolute language proficiency variables in §5.2. Subsequently, children's relative language proficiency is examined in §5.3.

5.1 Language experience variables

Table 1 presents a summary of the language experience variables.

--- INSERT TABLE 1 ABOUT HERE ---

As expected given that the children all reside in the Netherlands and attend Dutch-language daycare/school, most of the children's language exposure is in Dutch, both in general (AMOUNT) and with respect to extra-curricular activities (RICHNESS). Consequently, most of their language exposure hitherto (CumuLoE) has been in Dutch. At home, children speak more Dutch (OUTPUT) than they are spoken to.

There are on average slightly more different people speaking Dutch than English, and the number of people with whom the child exclusively speaks English is half that of Dutch. In both languages, most of the input comes from native or near-native speakers.

5.2 Absolute language proficiency

Table 2 summarises the results of the various language proficiency measures.

--- INSERT TABLE 2 ABOUT HERE ---

Children were on average more verbose in Dutch, producing more than twice as many utterances in this language than in English. Mixing was pervasive in the interactions in English, whereas this was virtually non-existent in Dutch, i.e., children regularly used Dutch with their English-speaking parent whereas they hardly ever used English with their Dutch-speaking parent. This is consistent with the parental report data concerning children's language use at home (cf. OUTPUT in Table 1). Comparing children's scores in the two languages, significant differences with higher scores for Dutch than English are found for MLU (Z = -3.11, p = .002), VERBS (Z = -2.51, p = .012) and UB5 (Z = -3.28, p = .001), but not for NOUNS (Z = -1.46, p = .144) or vocabulary (Z = -1.53, p = .127).[4]

All but one of the children reach or exceed age-appropriate (monolingual) norms for vocabulary in at least one of their languages and most (n=14) fall within or

[4] Given the small sample size, non-parametric tests are used.

exceed age-appropriate (monolingual) norms on both. There is one child who scores below average (for monolinguals) on both languages.

Bivariate correlations were carried out to ascertain the extent of any relationship between the language experience variables (Table 1) and the absolute proficiency scores (Table 2). For Dutch, the only significant correlation was between OUTPUT and UB5 (r = -.57, p = .013).

For English, there were significant correlations with AMOUNT for UTT (r = .77, p < .001), MIX (r = .78, p < .001), MLU (r = .69, p = .002), UB5 (r = .57, p = .014), VERBS (r = .71, p = .001), NOUNS (r = .50, p = .037) and vocabulary (r = .63, p = .005); with OUTPUT for UTT (r = .87, p < .001), MIX (r = .92, p < .001), MLU (r = .87, p < .001), UB5 (r = .73, p < .001) and VERBS (r = .83, p = .001); and with EXCL for UTT (r = .89, p < .001), MIX (r = .89, p < .001), MLU (r = .91, p < .001), UB5 (r = .75, p < .001), VERBS (r = .87, p < .001) and the correlation between EXCL and vocabulary was marginally significant (r = .47, p = .051).

5.3 Relative language proficiency i.e., dominance

Children's differential scores, i.e., their scores for English subtracted from the scores for Dutch, are given in the rightmost column of Table 2.[5] A positive differential score

[5] Given that the number of utterances a child is likely to produce and the extent to which code-mixing is used are unlike measures such as MLU, in the sense that the latter are indicative of increasing complexity in language development, rather than simple productivity, calculating differential scores for UTT (and MIX) was inappropriate. This section therefore concentrates on MLU, UB5, VERBS and NOUNS.

indicates better performance in Dutch, and a negative score better performance in English.

Bivariate correlations were carried out between these scores and the experiential variables (cf. Table 1) in order to establish the extent of any relationship between children's language experience and their relative proficiency on the various measures. Significant correlations were observed with AMOUNT for MLU_{diff} (r = .56, p = .016) and $VERBS_{diff}$ (r = .64, p = .004); with OUTPUT for MLU_{diff} (r = .75, p < .001) and $VERBS_{diff}$ (r = .73, p = .001); and with EXCL for MLU_{diff} (r = .72, p = .001).

The next logical step would be to conduct a regression analysis to determine which experiential variables best predict children's differential scores. However, this is not possible because of the size of the sample (n=18), because the number of significantly correlating predictor variables is limited, and most importantly, because there is a problem of multicollinearity, i.e., AMOUNT and OUTPUT are strongly correlated with each other (r = .80, p < .001).

The differential scores are continuous variables indicating the extent of any discrepancy between the two languages on a given proficiency measure. In an attempt to establish at what point one can speak of dominance, and ultimately the extent to which this is related to language experience, children were divided into dominance groups for those variables exhibiting significant correlations with AMOUNT, OUTPUT and/or EXCL.

Bernadini and Schlyter (2004) consider children to be dominant (or in their terms 'stronger') in one language when there is a difference in MLU of about one word. This approach was adopted here in a slightly modified fashion such that it could be extended to measures other than MLU. More specifically, we classified children as

dominant in one language when there was a difference between the two languages on the variable in question of more than one standard deviation (SD); we reasoned that this was an appropriate strategy given that (i) the SD for MLU differentials (0.91) was approximately one word and therefore our analysis would be comparable to that of Bernadini and Schlyter (see also Yip & Matthews, 2006, 2007), (ii) like the MLU differentials, the differentials for VERBS (and incidentally, all other variables) were normally distributed and hence a comparable analysis could be conducted, and (iii) using the SD was preferable to choosing some arbitrary value for each.

When children were divided into dominance groups for MLU_{diff}, there were 10 children categorised as balanced i.e., $MLU_{diff} \leq 0.91$, and 8 children categorised as Dutch-dominant, i.e., $MLU_{diff} > 0.91$ and their score for Dutch was higher.[6] There were no English-dominant children. The average MLU_{diff} for the balanced group was 0.24 (*SD* 0.47) and 1.75 (*SD* 0.53) for the Dutch-dominant group. The children in the Dutch-dominant group had significantly higher scores than the children in the balanced group for both AMOUNT ($U = 73.0$ $p = .003$) and OUTPUT ($U = 76.5$, $p < .001$): compare 71% (*SD* 7%) for AMOUNT for the Dutch-dominant group with 53% (*SD* 12%) for the balanced group, and for OUTPUT, 97% (*SD* 3%) versus 59% (*SD* 25%), respectively. The relative distribution of the groups and their relation to the experiential variables is presented in Figure 1 for AMOUNT and Figure 2 for OUTPUT.

--- INSERT FIGURES 1 and 2 ABOUT HERE ---

[6] The fact that the mean and SD for MLU_{diff} are identical is potentially confusing here, but the intended value is the SD.

Figure 1 reveals a striking pattern: the children in the Dutch-dominant group, i.e., children whose MLU is approximately one word longer in Dutch than in English, all have at least 65% exposure to Dutch, whereas amount of exposure in the balanced group almost always falls below this value. Figure 2 also shows a clear distribution with children in the Dutch-dominant group speaking Dutch at home for at least 90% of the time, whereas children in the balanced group have OUTPUT scores across the whole range.

When children were divided in dominance groups for $VERBS_{diff}$, there were 10 children categorised as balanced i.e., $VERBS_{diff} \leq 7.2$, and 8 children as balanced i.e., $VERBS_{diff} > 7.2$. Nine of the 10 children categorised as balanced for $VERBS_{diff}$ were also categorised as balanced for MLU_{diff}, and likewise for 7 of the 8 children in the Dutch-dominant group. Again, there were no English-dominant children. The average $VERBS_{diff}$ for the balanced group was -.10 (*SD* 4.58) and 16.3 (*SD* 4.95) for the Dutch-dominant group. The children in the Dutch-dominant group had significantly higher scores than the children in the balanced group for both AMOUNT ($U = 63.0$ $p = .043$) and OUTPUT ($U = 65.0$, $p = .027$): compare 68% (*SD* 12%) for AMOUNT for the Dutch-dominant group with 55% (*SD* 13%) for the balanced group, and for OUTPUT, 91% (*SD* 15%) versus 63% (*SD* 28%), respectively. There was no significant difference between groups for EXCL ($U = 22.0$, $p = .122$). The relative distribution of the groups and their relation to the experiential variables is presented in Figure 3 for AMOUNT and Figure 4 for OUTPUT.

--- INSERT FIGURES 3 AND 4 ABOUT HERE ---

Figures 3 and 4 reveal a similar pattern to Figures 1 and 2, respectively, i.e., children in the Dutch-dominant group have at least 65% exposure to Dutch and speak Dutch at home at least 90% of the time. This finding is unsurprising given the overlap in how children were distributed across dominance groups for $VERBS_{diff}$ and MLU_{diff}.

6. Discussion

In this paper we examined the relationship between various measures of children's language experience and their absolute and relative scores on a range of performance-based measures based on spontaneous speech data and a standardised vocabulary task.

Our first research question asked whether for simultaneous bilingual children there is a relationship between quantitative and/or qualitative properties of bilingual language experience and commonly-used performance-based measures of absolute and relative language proficiency. The results with regard to this question can be summarised as follows. Children's scores were generally higher for Dutch than for English, experiential variables did not correlate with language outcomes for Dutch,[7] whereas for English significant moderate to strong relationships were found between most of the *absolute* proficiency scores and the extent to which children are exposed to English, the extent to which they speak English at home and the number of exclusively English-speaking conversational partners at home. The same three experiential variables were also found to significantly correlate with children's

[7] The only exception was the negative correlation between UB5 and OUTPUT: this rather counter-intuitive result suggests that as children speak more Dutch at home, the average number of words in the longest five utterances in the sample decreases. It is not clear to me why this should be the case.

relative proficiency in the two languages as measured using differentials, i.e., their score for Dutch minus their score on the same variable for English.

The observation that certain properties of bilingual children's language experience are strongly correlated with their language development is in line with and corroborates previous findings for similar measures i.e., vocabulary and morphosyntactic complexity, with different language combinations (e.g., Gathercole & Thomas, 2009 for English-Welsh; Hoff et al., 2012 for English-Spanish). It is important to note that this observation concerns children's *rate* of acquisition in the sense that what is established is a relationship between children having reached a certain developmental stage and their cumulative input; no claims are made concerning *how* exactly children reached this stage (see Unsworth, in press for relevant discussion).

The finding that the minority language (English) appeared to be more affected by variation in the aforementioned properties of the input than the majority language (Dutch) is also in line with previous findings (Gathercole & Thomas, 2009); it is also possible of course that this is (at least in part) due to there simply being more variation between children in terms of how and when English input is provided when compared with Dutch.

In the current sample, experiential variables relating to input quantity appear to be more closely related to children's absolute and relative language proficiency than those relating to input quality. The only more qualitative variable found to correlate with (some) language outcomes was the number of conversational partners at home who exclusively speak English with the child, as observed by Place and Hoff (2011) for English-Spanish bilingual toddlers growing up in the US. There are at least two potential interpretations for this finding. First, it is possible that the existence of

multiple conversational partners with whom the child speaks the minority language only reinforces the functional significance of that language, and consequently supports its development (Fishman, Cooper & Ma, 1971, qtd. in Place & Hoff, 2011). Second, it may be the case that the number of exclusively English-speaking conversational partners simply increases the amount of English exposure, and this is what leads to higher (relative) proficiency.

The failure to find a significant correlation between children's absolute and/or relative proficiency scores and the extent to which their input is provided by native vs. non-native speakers is most likely due to the relatively restricted spread of scores for this variable for both languages i.e., most of the children's input is provided by native or near-native speakers; in studies with other populations where greater variation is attested the amount of non-native input has been found to be negatively correlated with bilingual children's language development (Hammer, Davison, Lawrence, & Miccio, 2009; Hoff et al., 2012).

Perhaps surprisingly, children's scores on vocabulary were not found to relate to any of the experiential variables (cf. e.g., Gathercole & Thomas, 2009; Hoff et al., 2012). This may be due to the comparatively high scores, i.e., virtually all of the children fell within (or exceeded) age-appropriate monolingual norms for both languages whereas bilingual children are typically found to fall below such norms in at least one if not both of their two languages (e.g., Bialystok et al., 2010; but cf. Thordardottir, 2011). This may in turn be due to the high SES of participating families (see e.g., Hoff, 2006); it is also possible that the high number of cognates across the two languages, English and Dutch, may have facilitated children's performance on their weaker language (see Groenen, 2011; Pérez, Pena, & Bedore, 2010 for relevant discussion).

In addition to measures such as MLU and number of different verbs, we also examined direction and amount of mixing as an indicator of language dominance. Mixing occurred into English but not into Dutch, and there was considerable variation between children. The amount of mixing in English was found to correlate with several of the experiential variables. However, using direction of mixing as a measure of dominance, as suggested for example by Bernardini and Schlyter (2004), Kupisch (2008) and Lanza (2004), would have lead to all the children in the present study being classified as Dutch-dominant. Given the range of scores on the other variables, it would seem that such a classification would fail to capture some of the variation in children's relative proficiency. Indeed, code-mixing has been subject to criticism as a measure of language dominance (see Cantone et al., 2008; Yip & Matthews, 2006 for relevant discussion).

Our second research question asked whether, assuming that children's language dominance is related to the patterns in their language experience, any of the specific experiential variables investigated here might usefully be implemented in future studies as a proxy for language dominance in the narrow sense of relative proficiency. Whilst the idea that amount of input is a predictor of language dominance is certainly not new (see e.g. Döpke, 1992), this has as yet not been subject to thorough investigation. Language dominance in the present study is understood as relative proficiency and as such was operationalised as a difference of approximately one word and of seven different verb types, the standard deviation for the differential scores for MLU and VERBS, respectively. On both these measures, there were slightly more Dutch-dominant children than balanced children and no English-dominant children. The children in the Dutch-dominant group were observed to have at least 65% exposure to Dutch and to speak Dutch at home at a rate of at least 90%,

whereas the percentages for the children in the balanced group were significantly lower, ranging from 34% to 71% for amount of exposure (when defined by either MLU_{diff} or $VERBS_{diff}$), and for output, from 20% to 90% (when defined by MLU_{diff}) or from 20% to 98% (when defined by $VERBS_{diff}$).

On the basis of these findings, we might predict that children with at least 65% exposure to a given language can be expected to be dominant in that language, at least for the measures adopted here and in the way in which dominance is defined here. This is largely in line with recent studies concerning how much input bilingual children need in order to reach monolingual norms on standardised tests (Thordardottir, 2011) or to be indistinguishable (as a group) from their monolingual peers (Hoff et al., 2012). Thordardottir (2011) observes that bilingual children reach age-appropriate monolingual norms once they reach a certain threshold in the amount of input (approximately 40% for receptive vocabulary and 60% for productive vocabulary); she furthermore speculates that input beyond this threshold may be superfluous in supporting further development. It is possible that a similar pattern holds here, that is, once amount of exposure reaches approximately 65%, children may be considered dominant in that language, but beyond that threshold, the degree of dominance does not appear to increase linearly. Whilst the data in the present study are certainly not incompatible with this speculation, it should be noted that there are only two children with exposure rates above 70%, and hence further research is necessary to (dis)confirm this possibility. Furthermore, to be clear, the prediction made here concerning 65% as a possible threshold for dominance (as measured by MLU and number of different verb types) concerns a bilingual child's relative proficiency *within that child*; on the basis of the present data, no predictions can be

made concerning whether the child's proficiency level in the dominant language is comparable to that of monolingual peers (cf. Thordardottir's study).

In the present study, children's input and output were measured separately. As the strong correlation between input and output scores indicates, however, the two are inextricably linked with each other. Indeed, in many studies the languages spoken *to* the child and those spoken *by* the child are often combined into a composite score (Bedore et al., 2012; Paradis, 2011). Nevertheless, despite this clear interdependence, the present findings suggest that relationship between children's relative proficiency and input, on the one hand, and relative proficiency and output, on the other, does not appear to be identical. More specifically, it was only when children use a language at home almost all the time that they were considered significantly more proficient, or dominant, in that language, whereas to be classified as dominant on the basis of amount of input, the threshold was slightly lower. On a more general note, the present findings underscore the importance of bilingual children's own language use as an important factor in their linguistic development (Bohman et al., 2010; Hammer et al., 2012).

There are a number of limitations to the present study. First, the number of participants is relatively small and they are drawn from one specific population, i.e., high SES families speaking a high prestige language which is related to the majority language of the community of residence. Whilst this population is not at all dissimilar from many of those investigated in the bilingual first language acquisition literature, for a complete picture, different language combinations, including children from low(er) SES families, should be investigated. Second, the present study focussed on simultaneous bilingual children only, whereas many of the studies in the literature concern (early) successive bilingual children; whilst it is unclear whether these two

populations should be considered distinct with respect to the role of input quantity and/or quality, this question is ultimately an empirical one (see Bedore et al., 2012; Unsworth, 2013 for relevant discussion). Third, the extent to which the present results are informative with respect to the issue of dominance are of course only as good as the way in which dominance is operationalised, i.e., using differentials. Finally, on a related note, in the present study, a narrow definition of language dominance has been adopted, i.e., language dominance is understood as children's relative proficiency in their two languages; as Montrul (this volume) and others have highlighted; however, a more comprehensive definition of language dominance is also possible (and likely also desirable), wherein language proficiency is just one component part. On this broader definition, the present paper can be understood as an exploration of the different component parts of language dominance.

7. Conclusion

This small-scale study has documented the relationship between bilingual children's language experience, language development and language proficiency. A strong relationship was found between children's absolute and relative proficiency and certain experiential variables. These findings suggest that when language dominance is narrowly defined as relative proficiency, the use of amount of exposure is a valid means of operationalizing language dominance, at least for the population under investigation here, and that children's language use may also have potential as a proxy for language dominance in future studies on bilingual language development.

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Table 1. Language experience variables

Variable	Dutch		English	
	M	*SD*	*M*	*SD*
AMOUNT (%)	61	13	39	13
CumuLoE (in years)	2.2	0.5	1.5	0.4
NATIVE[a]	4.9	0.1	4.8	0.3
RICHNESS[b]	63	17	27	17
EXCL (# of people)	1.6	1.0	0.7	.91
VARIETY (# of people)	2.5	1.0	1.9	1.1
OUTPUT (%)	76	27	24	27

[a] Value on a scale from 0 (no fluency) to 5 (native(-like) fluency)
[b] Average % time spent on extra-curricular activities in given language

Table 2. Language proficiency variables (absolute and relative scores)

	Absolute scores				Relative scores	
Variable	Dutch		English		Differential (Dutch – English)	
	M	*SD*	*M*	*SD*	*M*	*SD*
UTT (#)	242	99	91	62	---	---
MIX (%)	1	3	45	35	---	---
MLU (in words)	3.2	0.7	2.3	1.1	.91	.91
UB5 (in words)	9.5	3.2	6.0	3.7	3.5	2.9
VERBS (#)	18.6	5.8	11.4	9.0	7.2	9.5
NOUNS (#)	16.7	6.6	13.0	6.4	3.7	9.9
Vocabulary (standard score)	103	14	98	11	12.4	4.8

Figure 1. Relation between children's MLU_{diff} scores, dominance groups and current amount (%) of exposure to Dutch

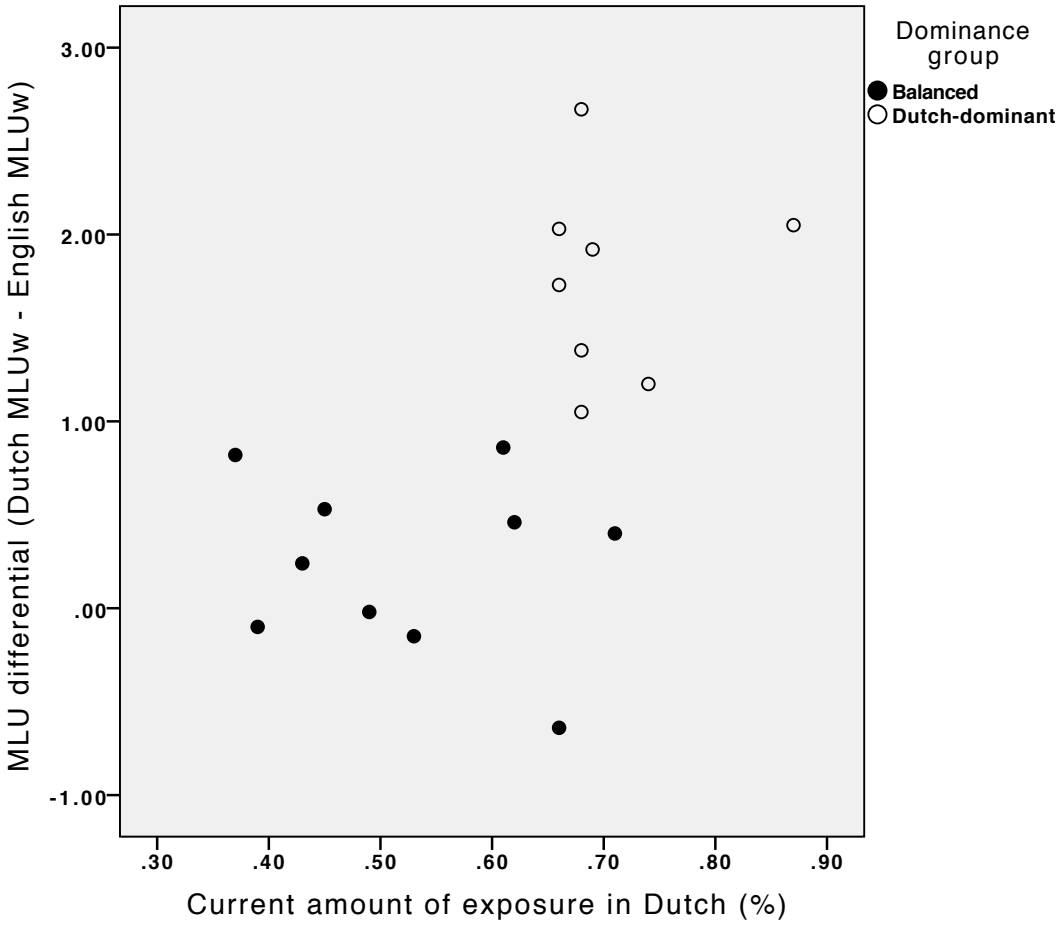

Figure 2. Relation between children's MLU_{diff} scores, dominance groups and child's average output at home in Dutch (%)

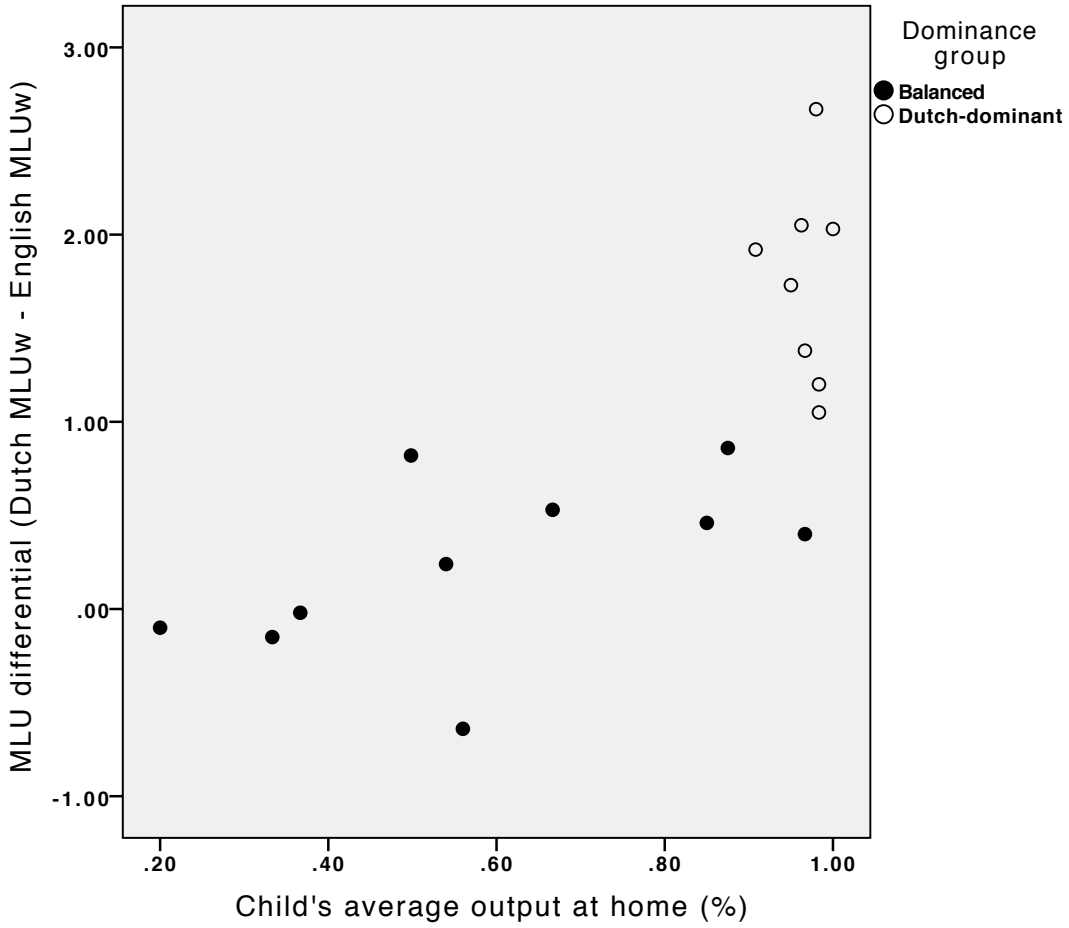

Figure 3. Relation between children's $VERBS_{diff}$ scores, dominance groups and current amount (%) of exposure to Dutch

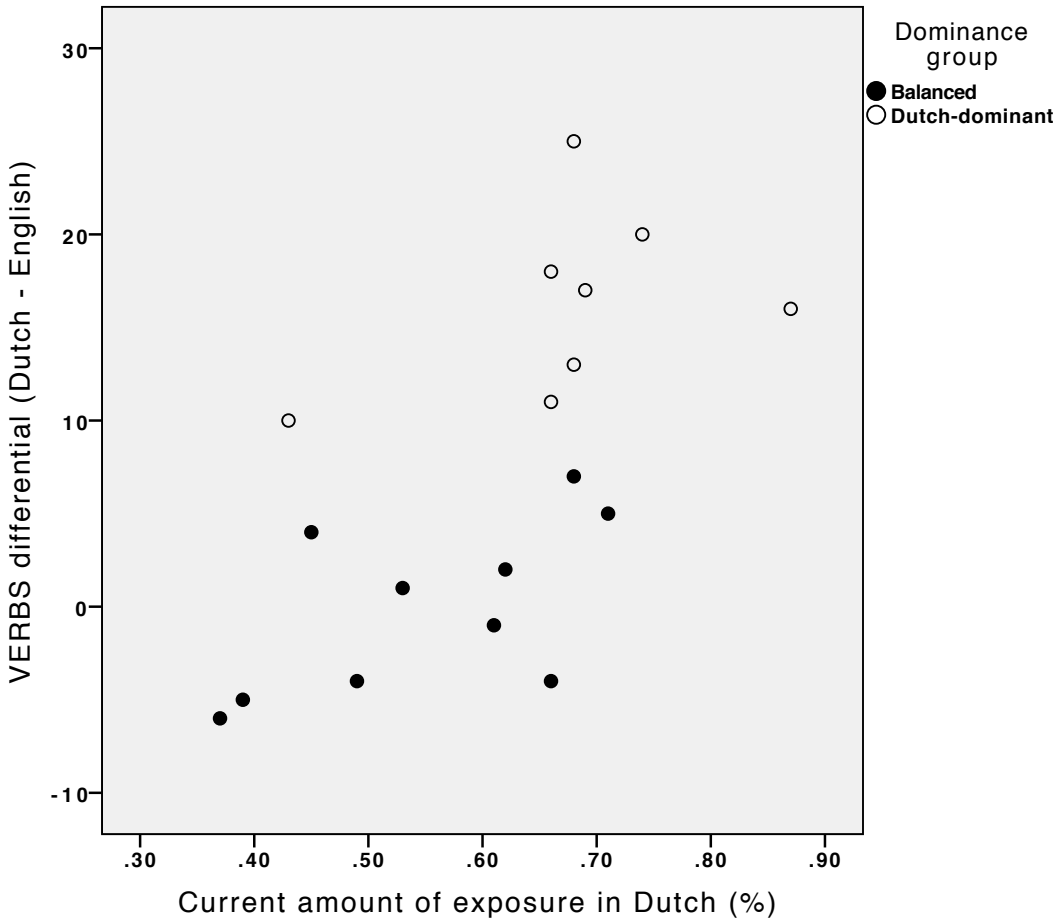

Figure 4. Relation between children's $VERBS_{diff}$ scores, dominance groups and child's average output at home in Dutch (%)